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ABSTRACT

This study assesses three methods of forecasting school enrollments: the cohort-sruvival method (grade progression), the statistical forecasting procedure developed by the Statistical Analysis System (SAS) Institute, and a simple ratio computation. The three methods were used to forecast school enrollments for kindergarten through grade 12 in a rural Tennessee school district. The cohort survival method is based on the calculation of a series of proportions that indicate the fraction of students in one grade in a given year who pass to the next grade; the ratios are averaged across 5 years to obtain the grade progression ratio. The SAS method is a statistical procedure based on extrapolation, and it fits and forecasts a univariate time series. The simple method uses the ratio of the 2 previous years' enrollments for each grade level; this ratio multiplied by the most recent year gives an estimate of expected enrollment for the following year. All three methods are based on the established consistency of the various ratios and variables. Study data included the number of live births and grade level enrollment figures. To test the accuracy of the three methods, the total enrollment obtained by each method was compared with the actual enrollment for the years 1987, 1988, and 1989. The cohort-survival projections were closest to actual enrollments; the next best technique was the simple ratio. One table and two graphs are included. (TJH)

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# SCHOOL DISTRICT ENROLLMENT PROJECTIONS:

# A COMPARISON OF THREE METHODS

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# SCHOOL DISTRICT ENROLLMENT PROJECTIONS:

# A COMPARISON OF THREE METHODS

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## Introduction

Forecasting school enrollments has become essential in educational planning. Most importantly, the forecasting process itself can help planners formulate strategies to deal with the enrollment dynamics affecting those enrollments.

Several techniques are available for forecasting school enrollments and each has its own advantages and disadvantages when employed in different settings. One method which seems to be in widespread use is the cohort-survival method also known as grade progression. (Tanner & Holmes, 1985). A second method is a statistical forecasting procedure developed by the SAS® Institute. In this study these two techniques, along with a simple ratio computation, were used to forecast school enrollments for a rural school district and to determine which method resulted in more accurate projections.

## Data:

Enrollment projections need to be "best guess" efforts. They need to use easily duplicated procedures built on the basis of available data. The number of live

births is usually available, at least on a county basis. Live births are also a good predictor of first grade enrollments six years later. A second source of available data is grade level enrollment provided by the SEA or the LEA.

**Methods:**

Grade progression (cohort survival). This method is simple to use and yields good short-range forecasts. It also requires a minimal amount of data. The method is based on the calculation of a series of proportions that indicate the fraction of students in one grade in a given year who 'survive' to the next grade. These ratios are averaged across five years to obtain the grade progression ratio (GPR). This process is done for each grade level. The historical live birth ratio (also averaged over five years) is multiplied by the number of live births six years before the desired year to project probable 1st grade enrollments. Second to twelfth grade enrollments are projected based on the existing enrollments in a particular grade multiplied by the grade progression ratio. Kindergarten projection involves 'backwards' estimation. Here a ratio of 1st grade to kindergarten enrollment a year earlier is computed and used to project kindergarten enrollments. This is done because kindergarten enrollments are not yet as stable as 1st grade enrollments. In order to extend the enrollment projection through 1999, we had to estimate the live birth data for the corresponding years of 1989-1994. A compound interest formula based on average rates of growth (both positive and negative) was computed and applied to 1988 live birth data. The estimate for 1989 then became the base for 1990, and so on.

SAS Forecast. SAS® Forecast is a statistical procedure based on extrapolation. It fits and forecasts a univariate time series. The forecasts are functions only of time and past values, not of outside factors. Of the three methods offered

by the SAS Forecast procedure, the EXPO method was chosen because the minimum number of nonmissing observations required is two (SAS/ETS Guide, 1984).

Simple Ratio. The simple method uses the ratio of the two previous years enrollments for each grade level. This ratio multiplied by the most recent year gives an estimate of expected enrollment for the following year.

These three methods are based upon the assumption that constancy of the various ratios and variables that have existed in the past will continue into the future. Of course, this assumption may be false. A comparison of these three methods was carried out to measure relative accuracy by using a 'goodness of fit' test to compare actual versus projected enrollment over the period of 1987-1989. A similar procedure was followed looking at the projection of live birth data.

RESULTS:

The grade progression (cohort survival) forecast, and ratio methods were employed to project school enrollments for grades K-12 in a rural Tennessee school district. To test the accuracy of the three methods the total enrollment obtained by each method was compared with the actual enrollments for the years 1987, 1988 and 1989 (Table 1 and Figure 2). The percentage error was calculated for the three methods in comparison to the actual enrollments. Figure 1 depicts the projected and actual live birth data using the same three methods.

The grade progression method produced a projection 0.6 percent higher than the actual enrollment in the year 1987. In 1988 and 1989 the projections were 0.9 and 0.8 percent less than the actual. The Forecast method gave values greater than the actual enrollments for all three years (7.0, 6.0, and 6.0 percent

respectively. The third method was single ratio. Here the forecast for the first two years was 1.8 and 0.9 percent less than the actual enrollments, but in 1989 it over estimated the actual enrollment by 0.9 percent.

It is evident that the projections obtained from the grade progression method is much closer to the actual enrollments than the projections obtained from the other two methods. The ratio method is in close agreement with values obtained by GPR method for the year 1988.

For live births the "goodness" of fit (Figure 1.) revealed that the GPR and simple ratio techniques did the best job for the three test years. The SAS® Forecast method seemed the least accurate, at least for the data at hand.

DISCUSSION:

Forecasting techniques are important in estimating school enrollments. Although making projections is not always an easy or an accurate task it helps the school officials in planning. A thorough understanding of several techniques used will aid in analyzing the trends rather than concluding and planning based on any one single method.

The results of this study indicate that the projections obtained using the GPR method were closer to the actual enrollments than the other two methods. The next best technique was the simple ratio. This was also true for live birth data.

TABLE 1

Table showing total K-12 enrollments and percentage error ( ) obtained for each of the three methods.

| YEAR | GPR | FORECAST | RATIO | ACTUAL |
|---|---|---|---|---|
| 1987 | 9299(0.6) | 9889(7.0) | 9079(-1.8) | 9238 |
| 1988 | 9024(-0.9) | 9722(6.0) | 9025(-0.8) | 9103 |
| 1989 | 8910(-0.8) | 9528(6.0) | 9057(0.9) | 8973 |

# LIVE BIRTHS

# PROJECTED AND ACTUAL

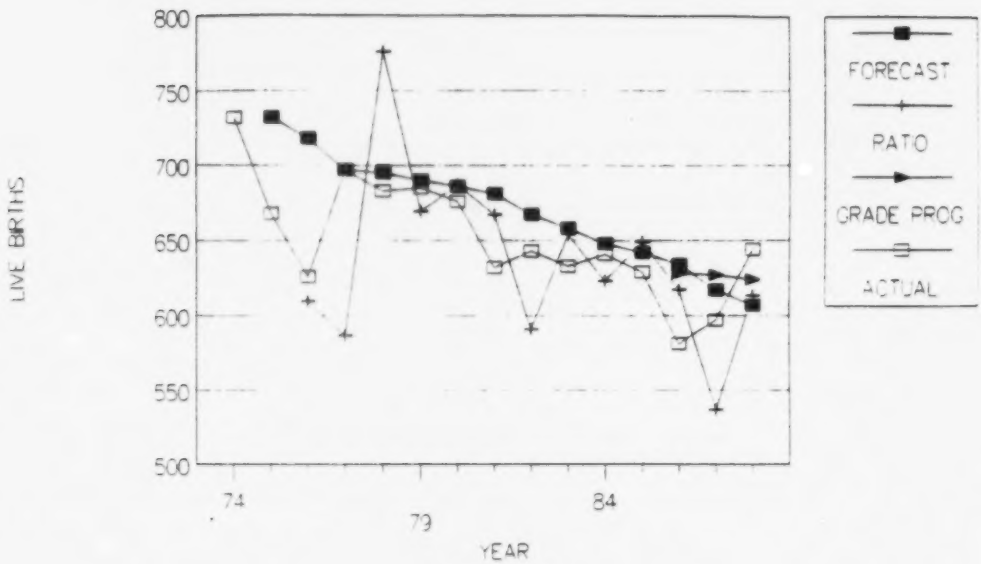


Figure 1

# K-12 ENROLLMENT PROJECTIONS

# AND ACTUAL ENROLLMENTS

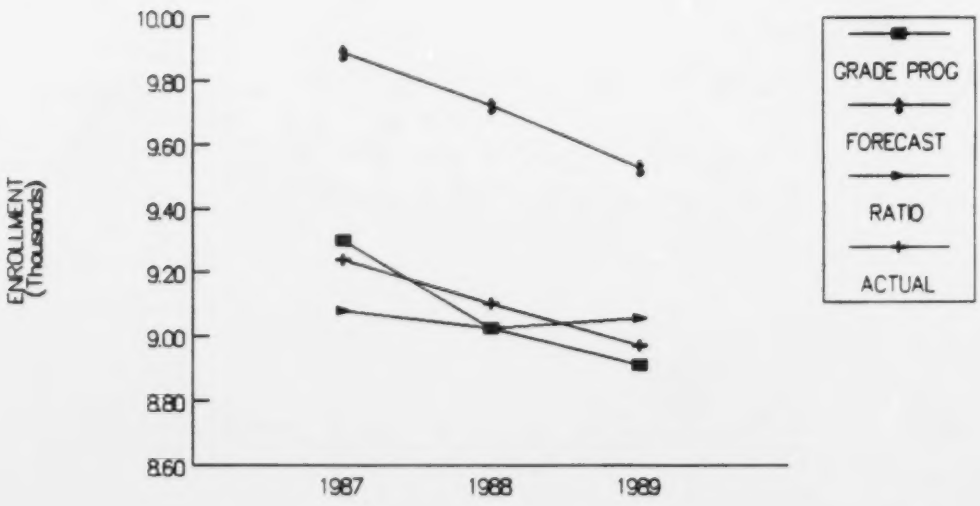


Figure 2

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